BRAEMAC

LITEMAX

LITEMAX LF1548

Sunlight Readable 15" LCD Display

(2nd Edition 8/21/2006)

All information is subject to change without prior notice.

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ii Record of Revision

Version and Date	Page	Old description	New Description	Remark
0.1 2004/3/25	All	First Edition for Customer	All	
0.2 2006/08/21	3			

2.0 General Description

This specification applies to the 15.0 inch Color TFT-LCD Module LF1548.

The display supports the XGA (1024(H) x 768(V)) screen format and 262,144 colors (RGB 6-bits data).

All input signals are 1 Channel LVDS interface compatible.

This module does not contain an inverter card for backlight.

Features

-XGA 1024(H) x 768(V) resolution

-12 CCFLs (Cold cathode Fluorescent Lamp)

-High contrast ratio, high aperture ratio

-Wide viewing angle

-High-speed response

-Low power consumption

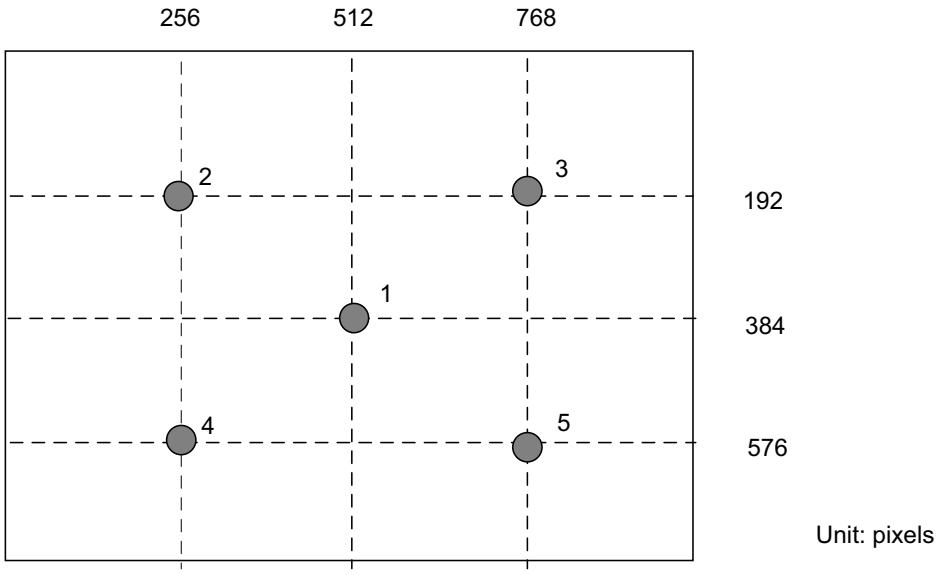
Application

Desktop monitors

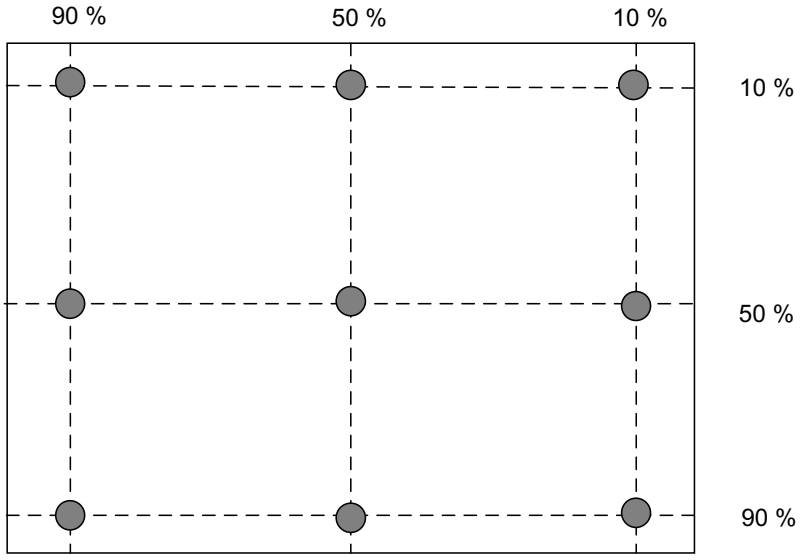
2.1 Display Characteristics

The following items are characteristics summary on the table under 25 ℃ condition:

ITEMS	Unit	SPECIFICATIONS
Screen diagonal	[mm]	381 (15")
Outline dimension	[mm]	326.5 x 253.5 x 19.46 typ.
Display Area	[mm]	304.128 (H) x 228.096(38.1cm diagonal)
Resolution		1024(R,G,B x 3) x 768
Pixel Pitch	[mm]	0.297 x 0.297
Pixel Arrangement		R.G.B. Vertical Stripe
Display Mode		TN mode, Normally White
Typical white Luminance.	[cd/m^2]	1400nit (typ) @6mA (note 1)
Brightness uniformity		80% typ. (note 2)
Luminance uniformity		1.7 max.(Note 3)
Crosstalk (at 60Hz)		1.2% max. (note 4)
Contrast Ratio		400 : 1 typ.
Support Colors		262,144 colors (6-bit for R,G,B)
Chromaticity(CIE1931) White-x		0.313
White-y		0.329
Color Gamut		60% typ., of NTSC coverage
Viewing angle		70(left),70(right),50(up),70(down) CR=10
Response Time	[msec]	16ms typ. (Tr +Tf)
Nominal Input Voltage VDD	[Volt]	+3.3 V
Power Consumption (VDD line + CCFL line)	[Watt]	56 (Max) @6mA (with Inverter)
Electrical Interface		LVDS (1 ch)
Frame rate	[Hz]	60Hz typ., 75Hz max.
Weight	[Grams]	1700 typ.
MTBF	[hour]	50000 hours (note 6)
Mounting method		Side mounting
Surface treatment		Anti-glare, hard coating (3H)
Temperature Range Operating Storage (Shipping)	 [^{o}C] [^{o}C]	 0 to +50 -20 to +60



Note 1: Brightness is measured at the center point of brightness value with all pixels displaying white.



Unit: percentage of dimension of display area

Note 2: Brightness uniformity of these 9 points is defined as below:

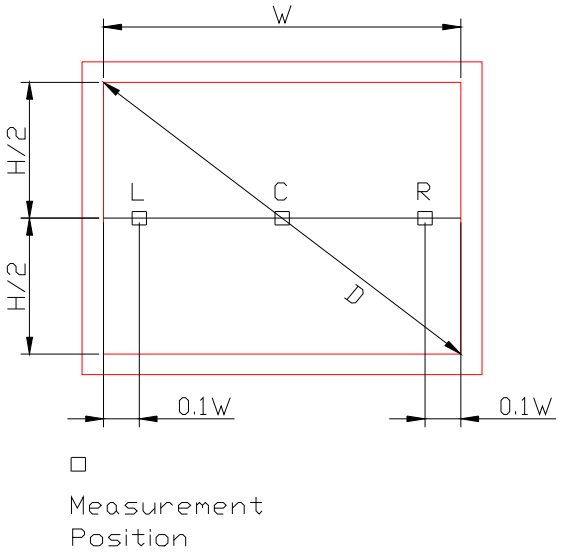
(Min. brightness / Max. brightness) x 100%

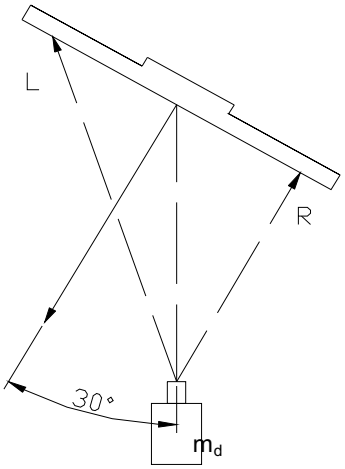
Note 3: TCO '99 Certification Requirements and test methods for environmental labeling of Display Report No. 2 defines Luminance uniformity as below:

((Lmax,+30deg. / Lmin,+30deg.) + (Lmax,-30deg. / Lmin,-30deg.)) / 2

TCO 99 certification requirements and test methods

1) Diagrammatic：





Effective area：W×H

$L_{max\cdot+30^\circ}$ and $L_{min\cdot+30^\circ}$

2) D is the diagonal of the screen in centimeters. And m_d is as follow.

m_d(cm)=D×1.5 with a minimum distance：m_d=50 cm

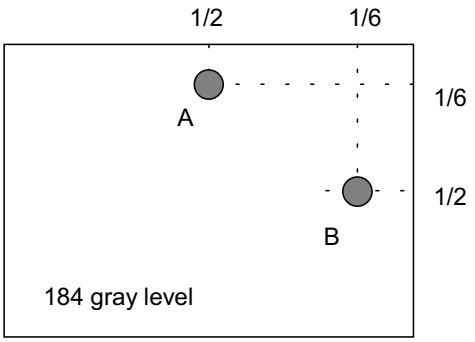
3) The measurement positions shall consist of an active white square of size 4 by 4 cm.

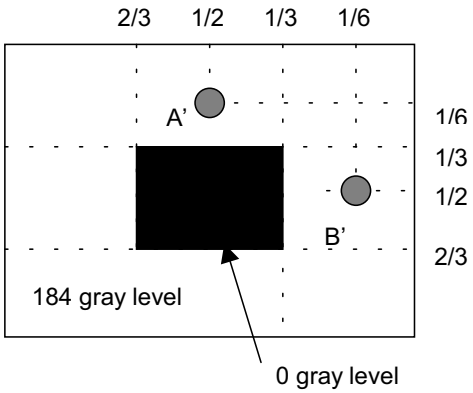
4) Measure $L_{max\cdot+30^\circ}$ and $L_{min\cdot+30^\circ}$ that are given as points L & R. And then rotated to an azimuth angle of –30 degrees and measure $L_{max\cdot-30^\circ}$ and $L_{min\cdot-30^\circ}$ again using the same procedure.

5) The variation in luminance ratio is calculated as the ratio:

$L_R = ((L_{max\cdot+30^\circ} / L_{min\cdot+30^\circ}) + (L_{max\cdot-30^\circ} / L_{min\cdot-30^\circ}))/2 \leqq$ **1.7**

Note 4:





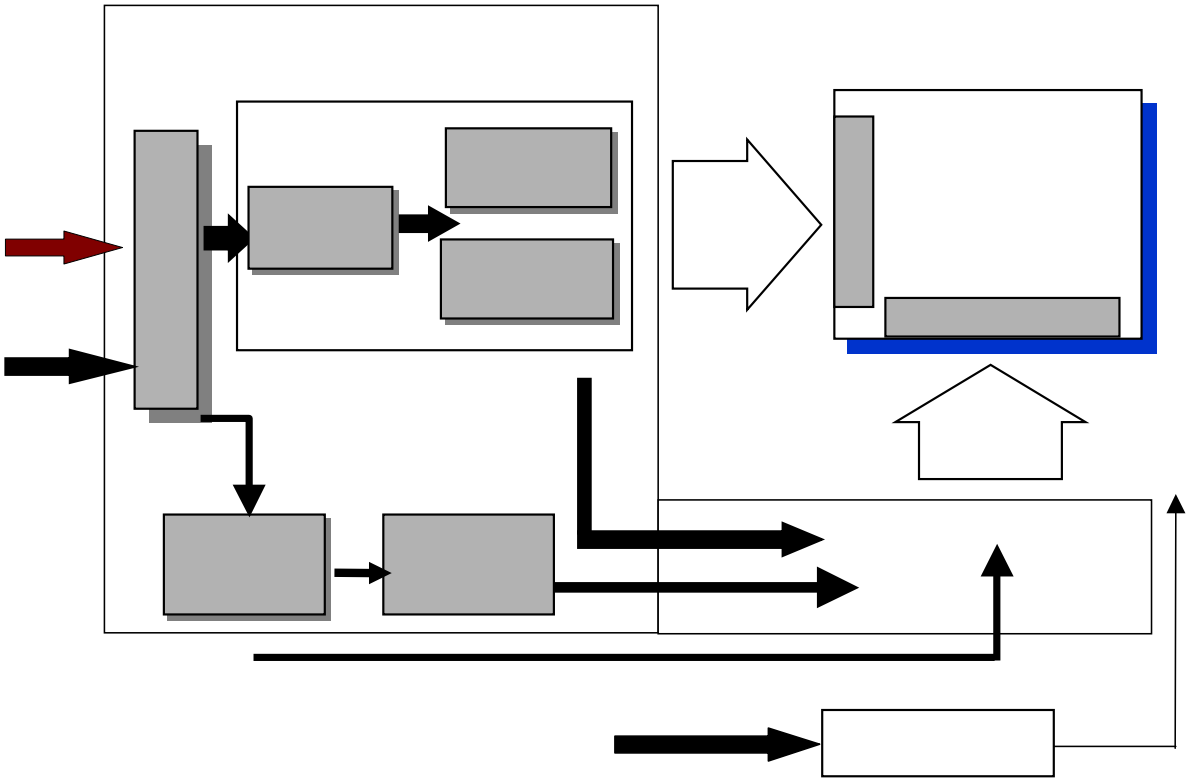
Unit: percentage of dimension of display area

I L_A-$L_{A'}$ I / L_A x 100%= 1.2% max., L_A and L_B are brightness at location A and B

I L_B-$L_{B'}$ I / L_B x 100%= 1.2% max., $L_{A'}$ and $L_{B'}$ are brightness at location A' and B'

Note 5: None Litemax VGA Luminance 1692 nits (typ.)

Note 6: CCFL Life time is determined as the time at which brightness.



3.0 Absolute Maximum Ratings

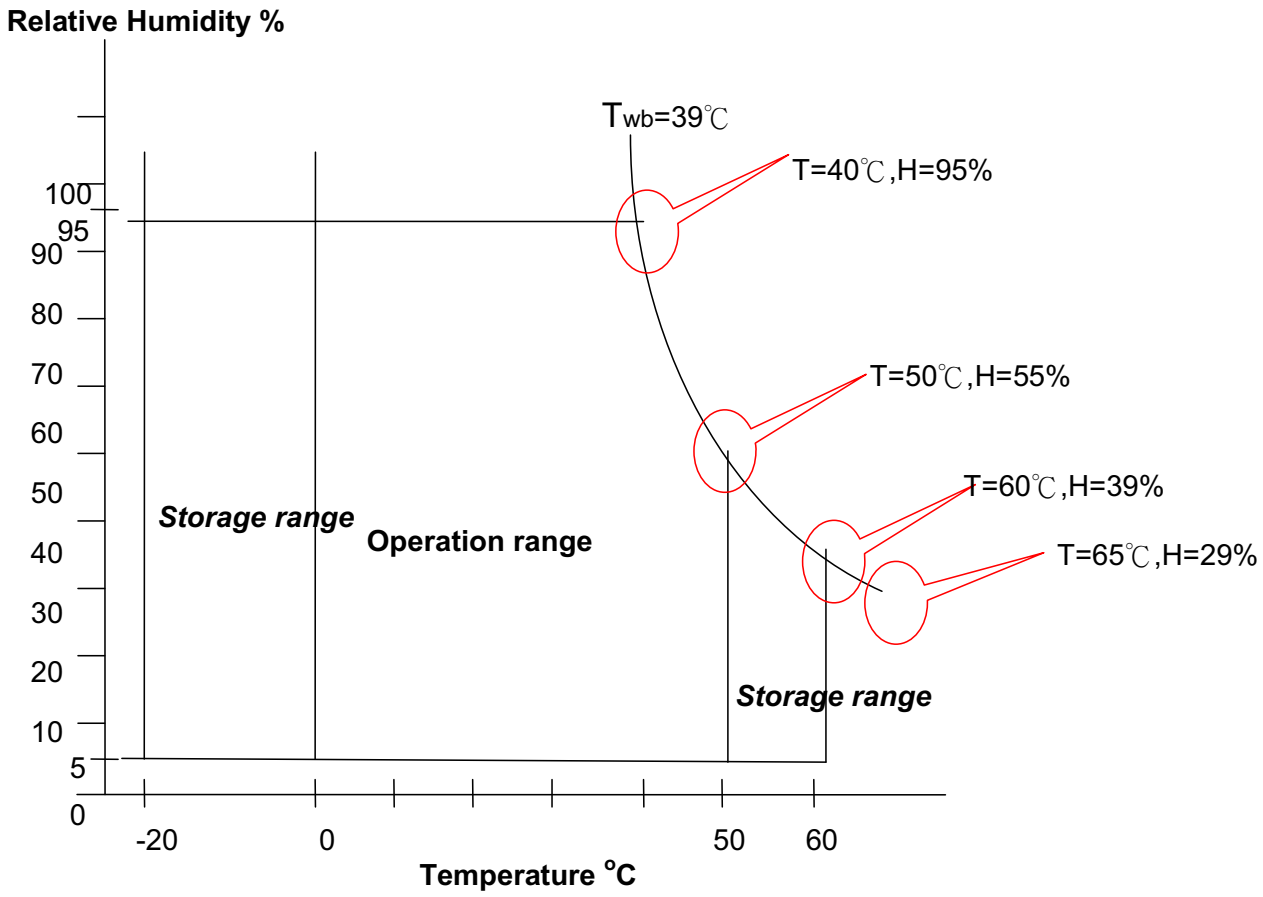
Absolute maximum ratings of the module is as following:

Item	Symbol	Min	Max	Unit	Conditions
Logic/LCD Drive Voltage	VDD	-0.3	+3.6	[Volt]	
Input Voltage of Signal	Vin	-0.3	VDD+0.3	[Volt]	
CCFL Current	ICFL	3.0	9.0	[mA] rms	Note 1
Operating Temperature	TOP	0	+50	[°C]	Note 2
Operating Humidity	HOP	20	85	[%RH]	Note 2
Storage Temperature	TST	-20	+60	[°C]	Note 2
Storage Humidity	HST	5	95	[%RH]	Note 2
Vibration			1.5 / 10-200	[G / Hz]	
Shock			50/20	[G / ms]	Half sine wave
Assured Torque at Side Mount			2.0	[kgf.cm]	
Re-screw			3	[Times]	

Note 1: To exceed 8.0mA, life time accelerate drop down and if to exceed 9.0mA has safety problem

Note 2 : Maximum Wet-Bulb should be 39℃ and No condensation.

Wet bulb temperature chart



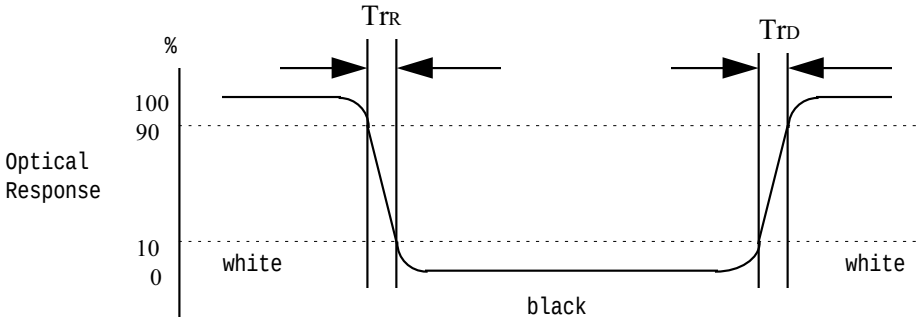
4.0 Optical Characteristics

The optical characteristics are measured under stable conditions at 25℃ (Room Temperature):

Item	Unit	Conditions	Min.	Typ.	Max.
Viewing Angle	[degree]	Horizontal (Right) CR = 10	-	70	
	[degree]	(Left)	-	70	
	[degree]	Horizontal (Right) CR =5	-	80	
		(Left)	-	80	
CR: Contrast Ratio	[degree]	Vertical (Upper) CR = 10	-	50	
	[degree]	(Lower)	-	70	
	[degree]	Vertical (Upper) CR = 5	-	75	
		(Lower)	-	80	
Contrast ratio		Normal Direction	300	400	-
Response Time(Note 1)	[msec]	Raising Time Ton (10%-90%)	-	4	6
	[msec]	Falling Time Toff (90%-10%)	-	12	17
	[msec]	Raising + Falling	-	16	23
Color / Chromaticity Coordinates (CIE)		Red x	0.587	0.617	0.647
		Red y	0.317	0.347	0.377
		Green x	0.260	0.290	0.320
		Green y	0.563	0.593	0.623
		Blue x	0.118	0.148	0.178
		Blue y	0.070	0.100	0.130
Color Coordinates (CIE) White		White x	0.283	0.313	0.343
		White y	0.299	0.329	0.359
Brightness Uniformity	[%]		75	80	-
White Luminance at CCFL 7mA	[cd/m^2]		-	1600	-
White Luminance at CCFL 5mA			-	1300	-
Crosstalk (in 60Hz)	[%]				1.2

Note 1: Definition of Response time:

The output signals of photodetector are measured when the input signals are changed from " Black" to " White" (falling time), and from "White" to " Black" (rising time), respectively. The response time interval between the 10% and 90% of amplitudes. Refer to figure as below.



5.0 Signal Interface

5.1 Module Interface Connectors

Physical interface is described as for the connector on module.

These connectors are capable of accommodating the following signals and will be following components

Connector Name	Interface Connector
Manufacturer	Hirose, PTWO or compatible
Type / Part Number	DF-14H-20P-1.25H (Hirose) CWY20G-A0D1T (PTWO)

5.2 Module Connector Pin Configuration

DF-14H-20P-1.25H (Hirose) or CWY20G-A0D1T (PTWO)		
Pin No.	**Symbol**	**Description**
1	VDD	Power Supply, 3.3V (typical)
2	VDD	Power Supply, 3.3V (typical)
3	VSS	Ground
4	VSS	Ground
5	Rin0-	- LVDS differential data input (R0-R5, G0)
6	Rin0+	+ LVDS differential data input (R0-R5, G0)
7	VSS	Ground
8	Rin1-	- LVDS differential data input (G1-G5, B0-B1)
9	Rin1+	+ LVDS differential data input (G1-G5, B0-B1)
10	VSS	Ground
11	Rin2-	- LVDS differential data input (B2-B5, HS, VS, DE)
12	Rin2+	+ LVDS differential data input (B2-B5, HS, VS, DE)
13	VSS	Ground
14	ClkIN-	- LVDS differential clock input
15	ClkIN+	+ LVDS differential clock input
16	VSS	Ground
17	Rin3-	NC
18	Rin3+	NC
19	VSS	Ground
20	NC	Reserved

5.3 Backlight Connectors

Connector Name / Designation	For Lamp Connector
Manufacturer	JST or compatible
Type / Part Number	BHR-04VS-1
Mating Type / Part Number	SM04(4.0)B-BHS-1-TB

5.4 Backlight Connector Pin Configuration

CN2, CN4

Pin #	Signal name
1	Lamp High Voltage
2	Lamp High Voltage
3	No connection
4	Ground

CN3, CN5

Pin #	Signal name
1	Lamp High Voltage
2	Lamp High Voltage
3	Lamp High Voltage
4	Lamp High Voltage

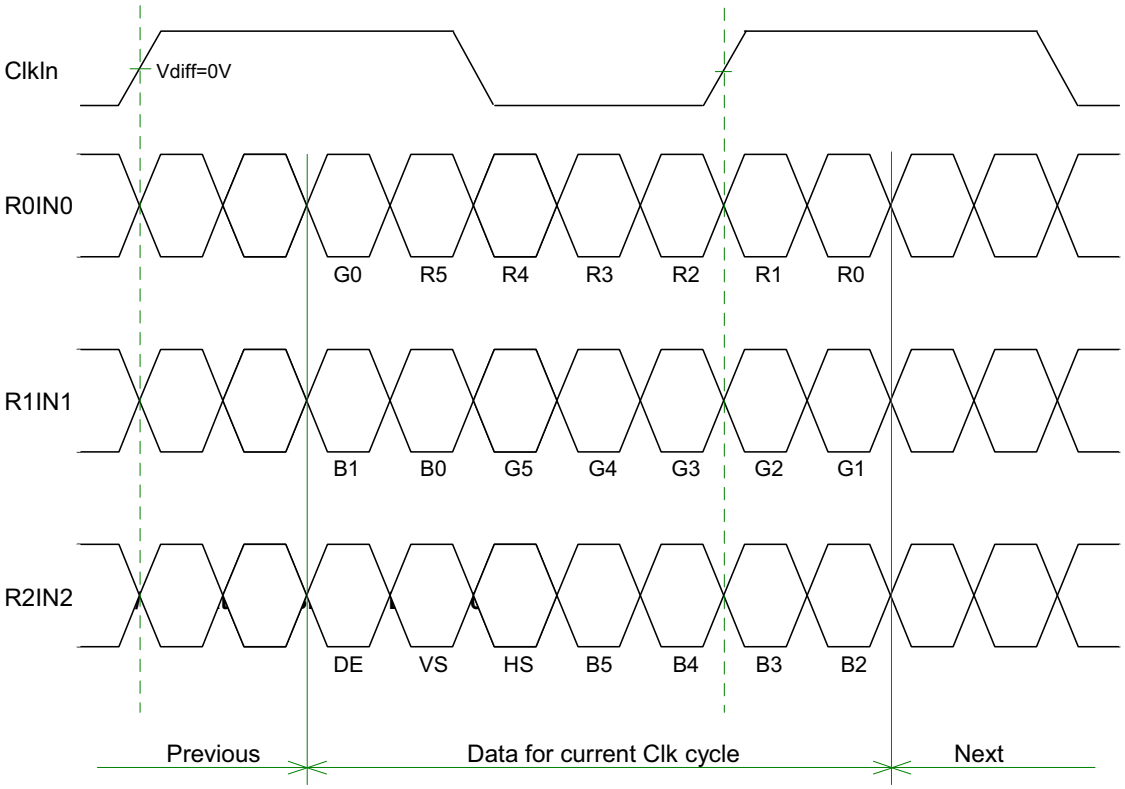
- Cable length: 200 +- 10 mm
- Connector-output position: right side (front view)
- Lamp assy design shall be easy for replacement and repair.

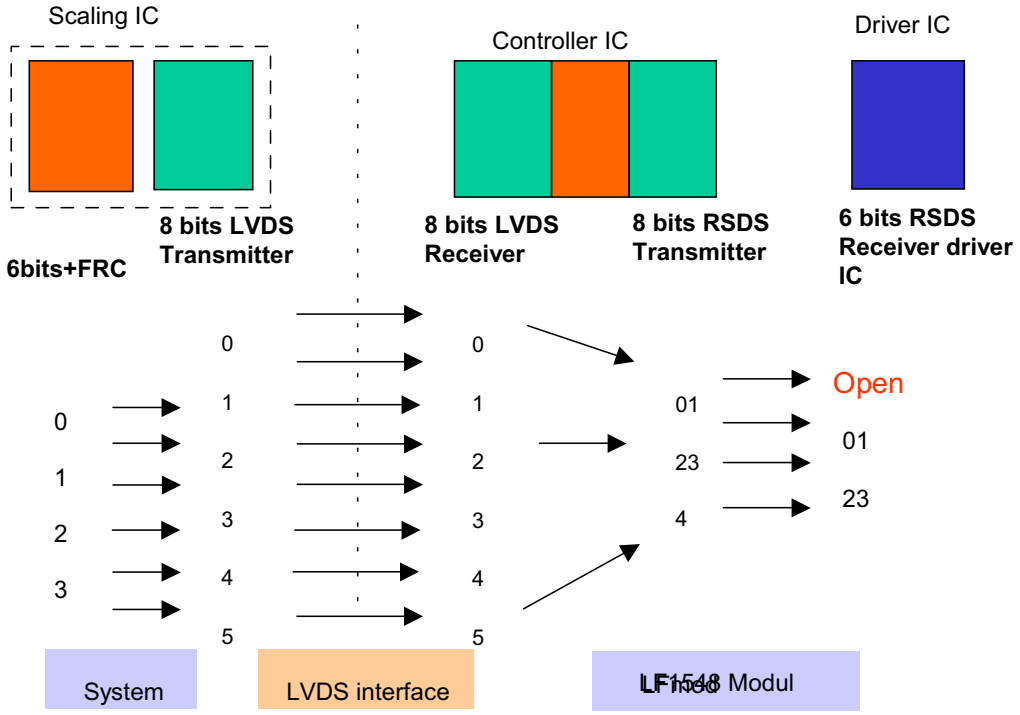
5.5 Signal Electrical Characteristics

Each signal characteristics are as follows;

Item	Symbol	Min	Typ	Max	Unit
LCD Drive voltage	VDD	+3.0	+3.3	+3.6	[V]
“High” input signal voltage	Vih	2.0	-	-	[V]
“Low” input signal voltage	Vil	-	-	0.8	[V]

6bits input data format





5.6 Signal Electrical Characteristics

Input signals shall be low or Hi-Z state when Vin is off
It is recommended to refer the specifications of SN75LVDS82DGG (Texas Instruments) in detail.

Each signal characteristics are as follows;

Parameter	Condition	Min	Max	Unit
Vth	Differential InputHigh Voltage(Vcm=+1.2V)		100	[mV]
Vtl	Differential Input Low Voltage(Vcm=+1.2V)	-100		[mV]

5.7 Interface Timings

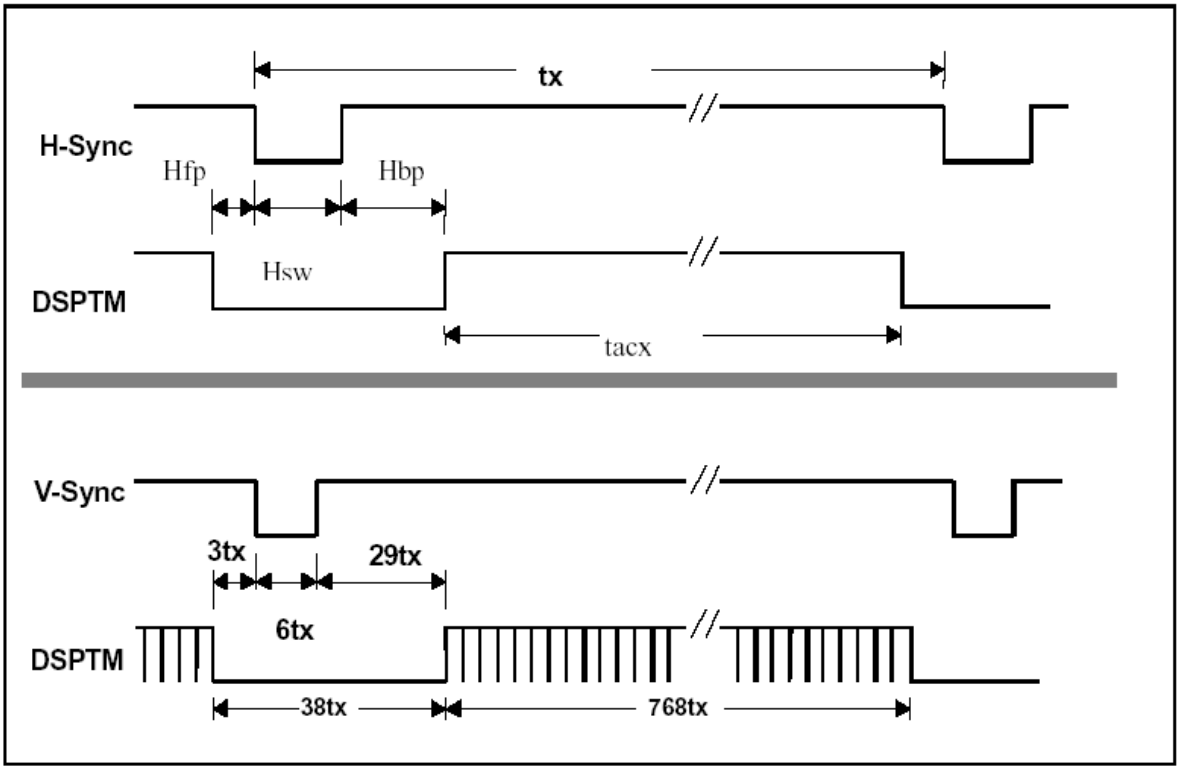
Basically, interface timings described here is not actual input timing of LCD module but output timing of SN75LVDS82DGG (Texas Instruments) or equivalent.

5.7.1 Timing Characteristics

Signal	Item	Symbol	MIN	TYP	MAX	Unit
DTCLK	Freq.	Fdck		65	81	MHz
DTCLK	Cycle	Tck	12.3	15.4		ns
+V-Sync	Frame Rate	1/Tv		60	75	Hz
+V-Sync	Cycle	Tv	13.33	16.7		ms
+V-Sync	Cycle	Tv		806		lines
+V-Sync	Active level	Tva		6		lines
+V-Sync	V-back porch	Tvb		29		lines
+V-Sync	V-front porch	Tvf		3		lines
+DSPTMG	V-Line	M		768		lines
+H-Sync	Scan rate	1/Th		60		KHz
+H-Sync	Cycle	Th		1344		Tck
+H-Sync	Active level	Tha(*1)		136		Tck
+H-Sync	Back porch	Thb(*1)		160		Tck
+H-Sync	Front porch	Thf		24		Tck
+DSPTMG	Display Pixels	N		1024		Tck

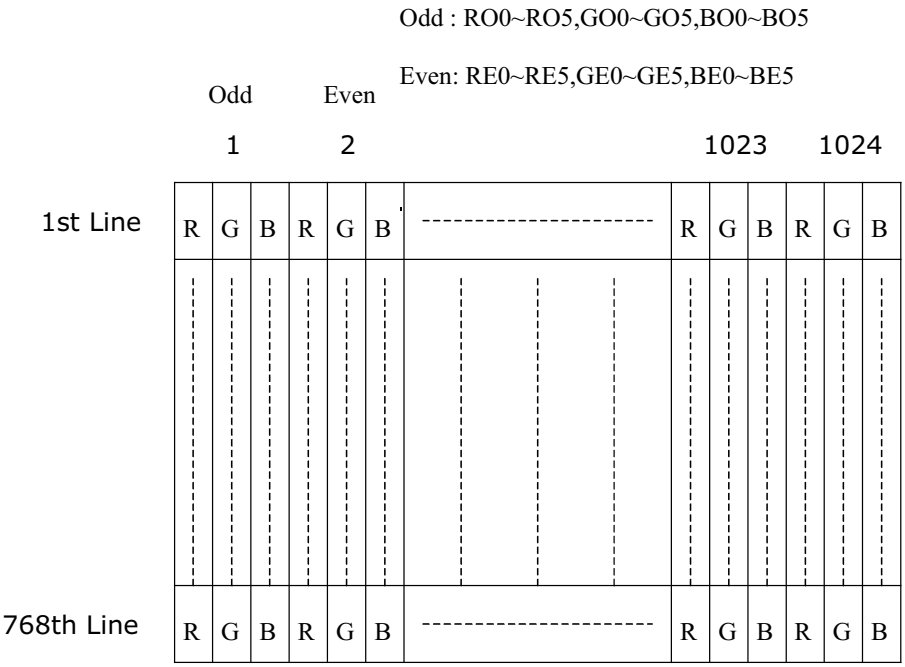
Note: Typical value refer to VESA STANDARD

5.8 Interface Timing Definition



6.0 Pixel format image

Following figure shows the relationship of the input signals and LCD pixel format.



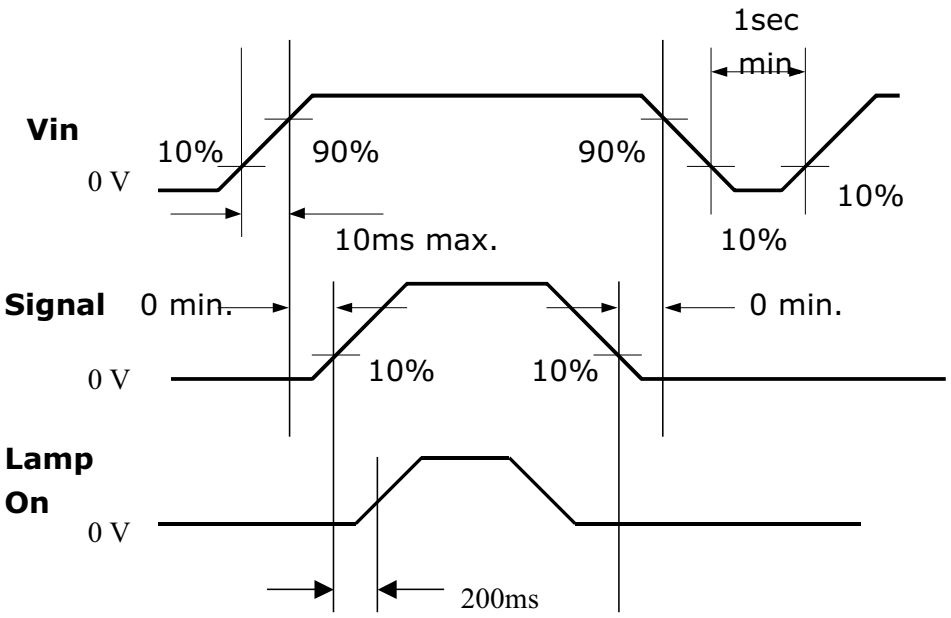
7.0 Power Consumption

Input power specifications are as follows;

Symbol	Parameter	Min	Typ	Max	Units	Condition
VDD	LCD Drive Voltage	3.0	3.3	3.6	[V]	
IDD	LCD Drive Current	-	1200	1500	[mA]	VDD=3.3v, All Black Pattern
PDD	LCD Drive power consumption	-	4.5	5	[Watt]	VDD=3.3v, All Black Pattern
VDDns	Allowable LCD Drive Ripple Noise			100	[mV] p-p	

8.0 Power ON/OFF Sequence

VDD power and lamp on/off sequence is as follows. Interface signals are also shown in the chart.



9.0 Backlight Characteristics

9.1 Signal for Lamp connector

CN2, CN4

Pin #	Signal name
1	Lamp High Voltage
2	Lamp High Voltage
3	No connection
4	Ground

CN3, CN5

Pin #	Signal name
1	Lamp High Voltage
2	Lamp High Voltage
3	Lamp High Voltage
4	Lamp High Voltage

9.2 Parameter guide line for CCFL Inverter

Symble	Parameter	Min	Typ	Max	Units	Condition
IRCFL	CCFL operation range	2.0	5.0	9	[mA] rms	(Ta=25℃) **Note 4**
FCFL	CCFL Frequency	25	-	100	[KHz]	(Ta=25℃) **Note 1**
ViCFL (25℃) (reference)	CCFL Ignition Voltage			680±10%	[Volt] rms	(Ta= 25℃) **Note 3**
VCFL	CCFL Discharge Voltage (Reference)		320±10%		[Volt] rms	(Ta=25℃) **Note 2**
PCFL	CCFL Power consumption @ 5mA (excluding inverter)		1.8		[Watt]	(Ta=25℃) **Note 2**

Note 1: CCFL Frequency should be carefully determined to avoid interference between inverter and TFT LCD
Note 2: Calculator value for reference (IRCFL×VCFLx2=PCFL)
Note 3: CCFL inverter should be able to give out a power that has a generating capacity of over 1300 voltage. Lamp units need 1300 voltage minimum for ignition
Note 4: CCFL life time 50,000hr at 5mA,it's defined as when the brightness is reduced by half. To exceed 5.0mA,life time will drop down dramatically.

10.0 Vibration,Shock,and Drop

10.1 Vibration & Shock

The module shall work error free after following vibration and shock condition. Likewise the module shall not sustain any damage after vibration and shock test.

10.1.1 Vibration Test Spec:

- Frequency: 10 - 200Hz
- Sweep: 30 Minutes each Axis (X, Y, Z)
- Acceleration: 1G(10~200Hz P- P)
- Test method:

Acceleration (G)	1
Frequency (Hz)	10~200~10
Active time (min)	30

10.1.2 Shock Test Spec:

Acceleration (G)	20
Active time(ms)	20
Wave form	Half-sin
Times	1

- Direction: ±X , ±Y, ±Z

10.2 Drop

Package test: The drop height is defined as 60 cm.

(1 corner,3 edges,6 flat faces)
-- No damage and defect found for panel.

11.0 Environment

The display module will meet the provision of this specification during operating condition or after storage or shipment condition specified below. Operation at 10% beyond the specified range will not cause physical damage to the unit.

11.1 Temperature and Humidity

11.1.1 Operating Conditions

The display module operates error free, when operated under the following conditions;

Temperature	0 ^{0}C to 50 ^{0}C
Relative Humidity	20% to 85%
Wet Bulb Temperature	39.0 ^{0}C

11.1.2 Shipping Conditions

The display module operates error free, after the following conditions;

Temperature	-20 ^{0}C to 60 ^{0}C
Relative Humidity	5% to 95%
Wet Bulb Temperature	39.0 ^{0}C

11.2 Atmospheric Pressure

The display assembly is capable of being operated without affecting its operations over the pressure range as following specified:

	Pressure	**Altitude**
Maximum Pressure	1040 hPa	0 m = sea level
Minimum Pressure	601 hPa	3658 m = 12,000 feet

Note: Non-operation altitude limit of this display module = 40,000 feet. = 12193 m.

11.3 Thermal Shock

The display module will not sustain damage after being subjected to 100 cycles of rapid temperature change. A cycle of rapid temperature change consists of varying the temperature from -20^{0}C to 60^{0}C, and back again.

Thermal shock cycle	-20 ^{0}C for 30min
	60 ^{0}C for 30min

Power is not applied during the test. After temperature cycling, the unit is placed in normal room ambient for at least 4 hours before powering on.

12.0 Reliability

This display module and the packaging of that will comply following standards.

12.1 Failure Criteria

The display assembly will be considered as failing unit when it no longer meets any of the requirements stated in this specification. Only as for maximum white luminance, following criteria is applicable.

- **Maximum white Luminance shall be 75 cd/m^2 or more.**

12.2 Failure Rate

The average failure rate of the display module (from first power-on cycle till 1,000 hours later) will not exceed1.0%. The average failure rate of the display module from 1,000 hours until 10,000 hours will not exceed 0.70% per 1000 hours.

12.2.1 Usage

The assumed usage for the above criteria is:

- 220 power-on hours per month
- 500 power on/off cycles per month
- Maximum brightness setting
- Operation to be within office environment (25^{0}C typical)

12.2.2 Component De-rating

All the components used in this device will be checked the load condition to meet the failure rate criteria.

12.3 CCFL Life

The assumed CCFL Life will be longer than 50,000 hours under stable condition at 25±5 ^{0}C;
Standard current at 5.0 ±0.5 mA
Definition of life: brightness becomes 50% or less than the minimum luminance value of CCFL.

12.4 ON/OFF Cycle

The display module will be capable of being operated over the following ON/OFF Cycles.

ON/OFF	**Value**	Cycle
+VDD and CCFL power	36,000	10 seconds on / 10 seconds off

13.0 Safety

13.1 Sharp Edge Requirements

There will be no sharp edges or corners on the display assembly that could cause injury.

13.2 Materials

13.2.1 Toxicity

There will be no carcinogenic materials used anywhere in the display module. If toxic materials are used, they will be reviewed and approved by the responsible AUO Toxicologist.

13.2.2 Flammability

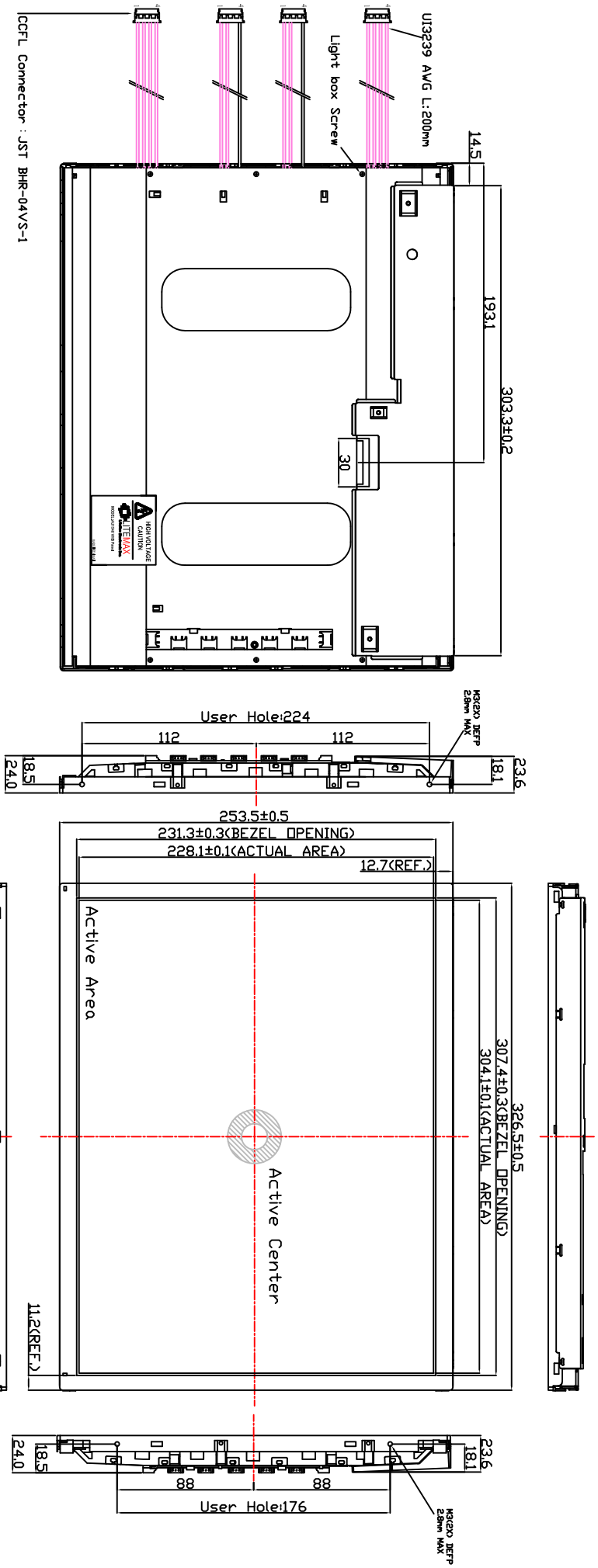
All components including electrical components that do not meet the flammability grade UL94-V1 in the module will complete the flammability rating exception approval process. The printed circuit board will be made from material rated 94-V1 or better. The actual UL flammability rating will be printed on the printed circuit board.

14.0 Other requirements

14.1 Smoke Free Design

Any smoke nor strange smell shall not be observed by the operator at any single failure.

Outline Dimensions
unit:mm



LI1215 Inverter

1. General

The DC To AC inverter is designed as a low noise high frequency high efficiency as a low profile and light weight switching power supply.

2. Feature

Applicable TO Litemax 12 CCFL 17”

Constant Current output

Possesses open load protection

No load –output auto stop

Meet TCO 99

RoHS Compliant

3. LCD Application

LCD SIZE	Lcm Model	Brand			
15”	AU 1548				

4. Operating Conditions

Item	Symbol	Conditions	MIN	MAX	Unit	Remark
Input Voltage	Vin		10	14-	V	
Operating Temperature	Top	Ha=90%RH	0	70	℃	
Storage Temperature	Tstg	Ha=95%RH	-10	80	℃	
Operating Humidity	Hop	Ta=0 55 ℃	20	90	%RH	
Storage Humidity	Hstg	Ta=20 80 ℃	-	95	%RH	

5. Operating Characteristics

Item	Symbol	Conditions	MIN.	TYP.	MAX.	Unit	Remark
Input Voltage	Vin	GND=0V	11	12	14	V	
Input Current (Min. Brightness)	IinL	Vin=TYP. ±1% ON VR=MIN (Iout=MIN)		100		mA	Dimming 4.8V
Input Current (Max. Brightness)	IinH	Vin=TYP. ±1% ON VR=MAX (Iout=MAX)	3400	3600	3900	mA	Dimming=0~0.1V
Lamp Current (Min. Brightness)	IoutL	Vin=TYP. ±1% ON VR=MIN (Iout=MIN)				mA rms	
Lamp Current (Max. Brightness)	IoutH	Vin=TYP. ±1% ON VR=MAX (Iout=MAX)	5.2	5.6	6.0	mA rms	Dimming=0~0.1V 1600nit
Lamp Frequency			49	51	53	KHZ	
DWM Duty Cycle Range		Tube Current	0%	-	100%-		
DWM			367	380	393	HZ	
Dimming Control		Connection of Voltage	5	-	0	V	
Output Voltage		CCFT Current =5mA		630		V	

Note: Dimming control (0-100%) is accomplished by the user providing a variable dc level of 0V(off) to 5V(full-on) at pin7 of CON8)

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6. Connector Socket

6-1. (CN8) Input Connector

PIN No	Symbol	Description
1~3	Vin	DC+12V
4~6	GND	GND (0V)
7	Brightness	Dimming Control
8	Control	ON/OFF control ON=+5V OFF=0V

6-2. (CN1~CN6) Output Connector

PIN NO	Symbol	Description
1	Output	Lamp High Voltage
2	Output	Lamp High Voltage

6-3. (CN7)

PIN No	Symbol	Description
1	GND	GND (0V) (Optional)
2	GND	GND (0V) (Optional)

6-4. Connector Model No & Brand

Connector No.	Connector Parts No	Brand
CN1~6	SM02(8.0)	JST
CN7	S2B-ZR-SM3	JST
CN8	S8B-PH-SM3-TB2	JST

S8B-PH-SM3 (pin1)

SM02 (8.0) (pin1)

S2B-ZR-SM3 (pin1)

7. Mechanical Characteristics

Dimension: 205mm*80mm*14mm

Weight:

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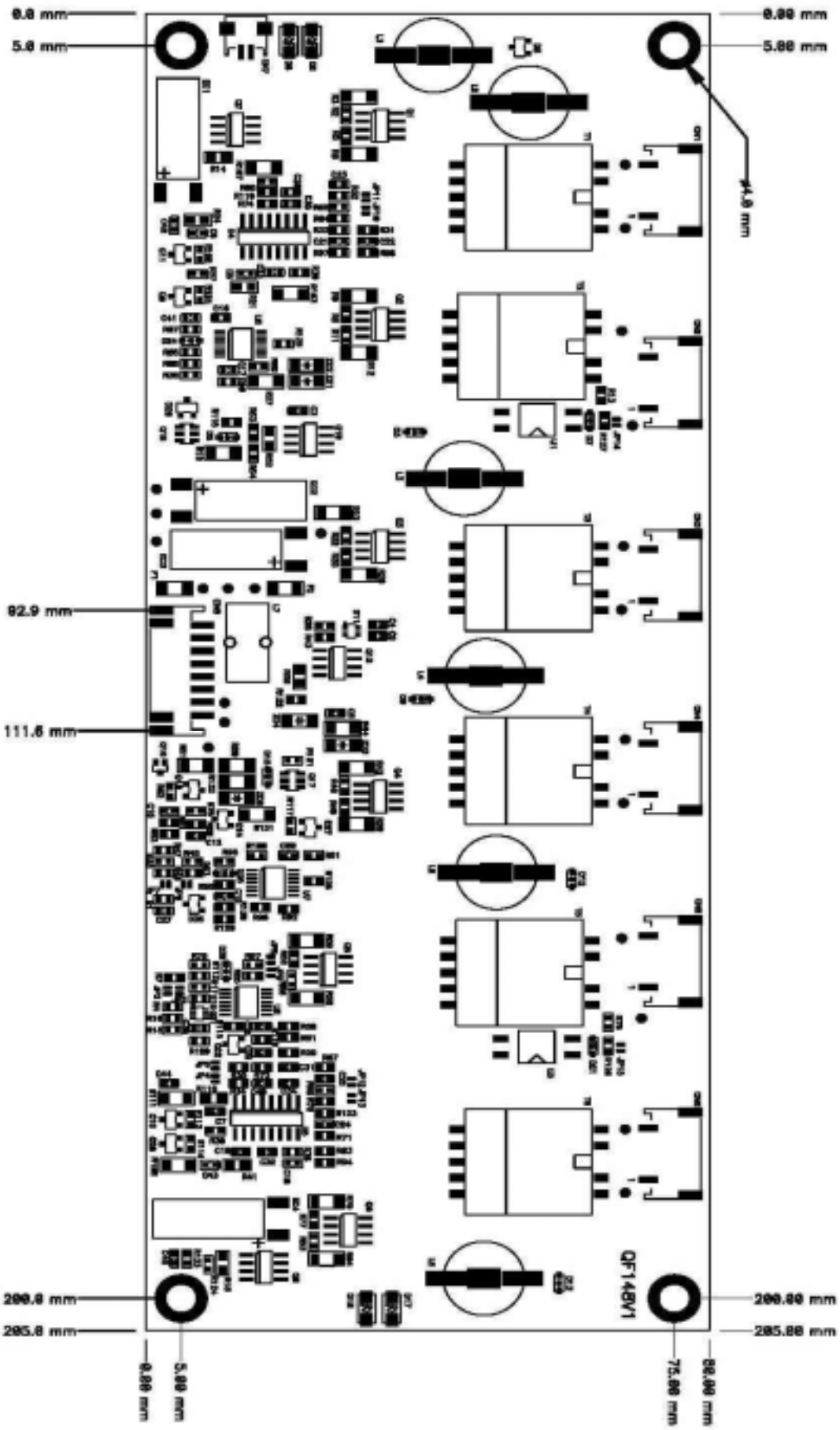
PCB DIMESION



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Sticker

TBD

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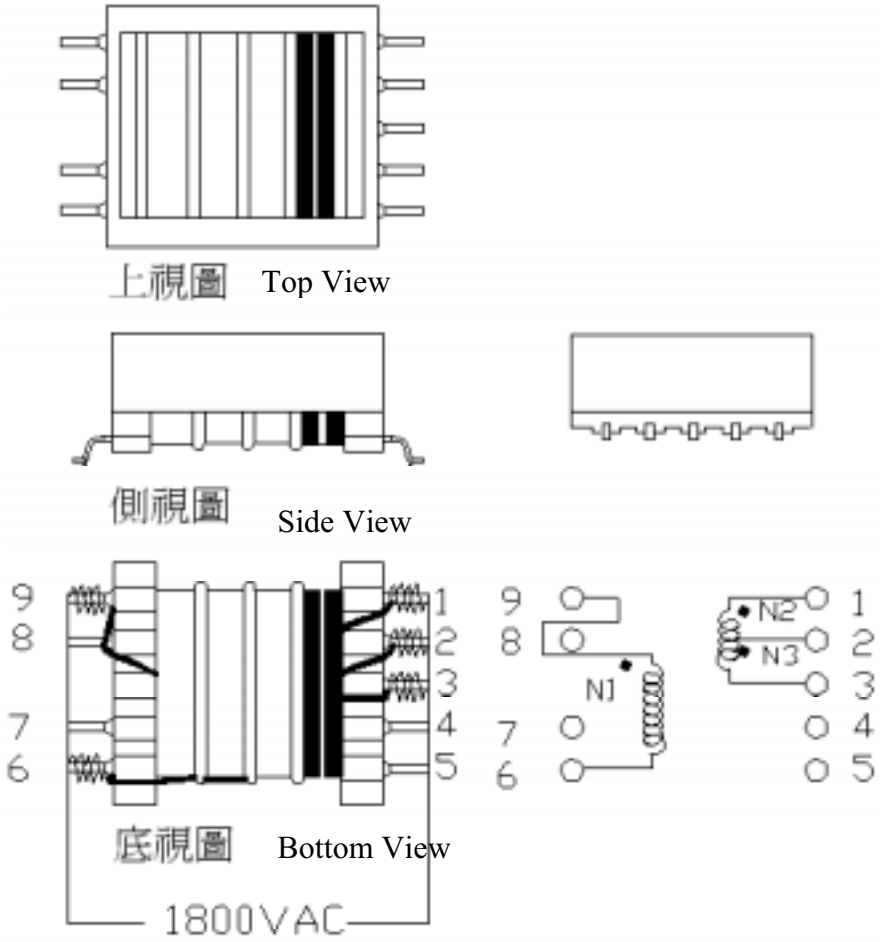
EFD15-TF505



Core									
Bobbin									
Tape									
Wire N1: 1 SFBW , SFBY , Pp155 ; N2,3:									
Impregnation			RPM						
Gap									
Color Yellow									
Pressure-proof : Primary to Secondary 1800Vac 5mA 60sec									
Remark:									
Insulation Tape Layers	Winding	Terminal Start ~ End	Wire Gauge(mm)	Turns	Color	H		DCR(Ω)	
						MAX	MIN	MAX	MIN
	N1	9 ~ 6	0.045 1SFBW	1920					
	N2	1 ~ 2	0.25 2UEW	14					
	N3	2 ~ 3	0.25 2UEW	14					
Remark:									

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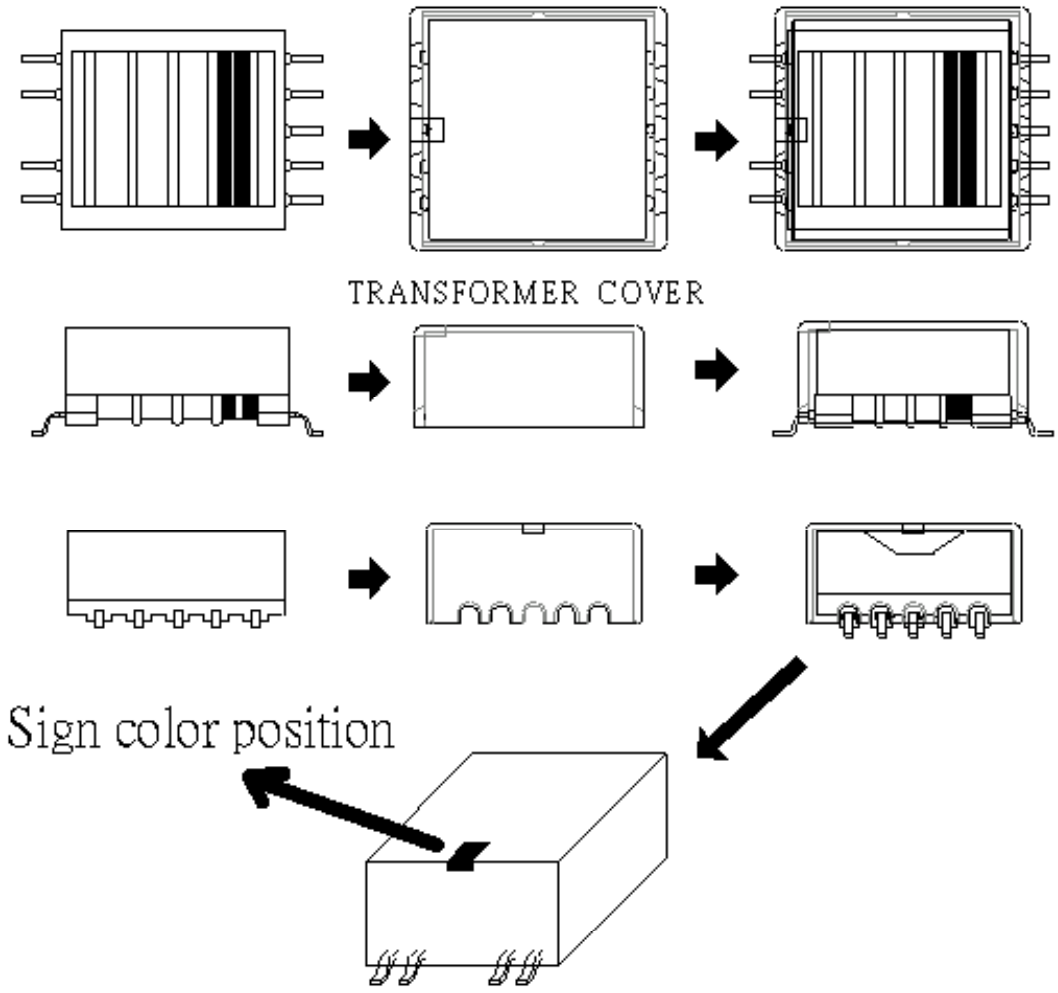
TF505 Packing Cover



TF505C

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QF Number:	Whether Uses	QF148V1			
ITEM		MATERIAL	CLASS	UL FILE NO	MANUF ACTURER
1.FERRITE CORE	ˇ	2F8;2G8			TOMITA
	ˇ	NC-2H			NICERA
2.BOBBIN	ˇ	LCP (94V-0) E4008L	130°C	E54705(M)	SUMITOMO CHEMICAL CO LTD
3.TAPE		3M NO.1350F-1(b)	130°C	E17385(N)	MINNESOTA MINING & MFG CO ELECTRICAL SPECIALTIES DIV
4.MYLAR FILM	ˇ	LUMIRROR Z2 (94VTM-2)	105°C	E86511(M)	TORAY INDUSTRIES INC FILM DIV
		FORMEX-18	105°C	E121855	ITWFORMEX CO.LTD
		ER	105°C	E110983	GARWARE POLYESTER.LTD
5.WIRE	ˇ	POLYURETHANE ENAMELLED COPPER UEW-2	130°C	E79029(S)	TOTOKU ELECTRIC CO.LTD
	ˇ	UEW-1(SFBW,SFBY)	155°C	E79029(S)	TOTOKU ELECTRIC CO.LTD
	ˇ	Pp155	155°C	E143312	ELEKTRISOLA CO.LTD
	ˇ	DD	130°C	E84081	PACIFIC ELECTRIC WIRE & CABLE CO.LTD
6.VARNISH	ˇ	BC-359	130°C	E51047(M)	JOHN C DOLPH CO
	ˇ	BC-346A	200°C	E51047(M)	JOHN C DOLPH CO
7.COVER	ˇ	LCP(94V-0) E4008L	130°C	E54705(M)	SUMITOMO CHEMICAL CO LTD
8.EPOXY		R-10(94V-0)	160°C	E70012(M)	ZU YU CHEMICAL CORP.
		F500A ; F500B	94V-0	E180899	HUNG SHIUNG ENTERPRISES CO.LTD
9. SILCONE RUBBER	ˇ	SE9189 GRAY RTV	150°C	E55519	DOW CORNING CO.LTD
	ˇ	1080 RTV	130°C	E40195	
RUBBER	v	777HFR	94V-0	E129576	O-KONG INDUSTRIES CO LTD

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ITEM		MATERIAL	CLASS	UL FILE NO	MANUF ACTURER
10.PCB	ˇ	03V0	130°C	E171781	ART P.C.B CORP
11.FUSE		251;429		E10480	LITTELFUSE INC
	ˇ	C1Q		E20624	BEL FUSE INC
	ˇ	3216FF		E19180	COOPER INDUSTRIES INC BUSSMANN DIV
		ICP-S		E107865	ROHM CO ., LTD.
12.PHOTO COUPLER	ˇ	LTV817		E113898	LITE-ON TECHNOLOGY

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